UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

JAN 19 2001

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United States v. Detroit Diesel Corporation,
Civil Action No. 98-2548

Dear Sirs,

You have requested a determination concerning the framework that the Environmental Protection Agency will employ in reviewing requests for approval of Auxiliary Emission Control Devices ("AECDs") for engines seeking approval for manufacture under the above-referenced Consent Decree ("Decree") for engines produced after October 2002. As you know, we have asked Detroit Diesel Corporation (DDC) for as much information as possible concerning the engines and control strategies at issue, the alternatives DDC has explored, and the emissions

impacts. You have indicated that technical information is not available at the level of detail that would ordinarily be in an application for certification because the engines are still in development, and that you are, therefore, only seeking information regarding the framework EPA will employ in making decisions about engines and AECDs during the certification process. Because the agency does not believe it is in the Nation's interest to bar the sale of engines, we will agree to allow DDC to produce and sell engines employing the AECDs as generally described and limited in this letter and accompanying enclosures.

As you know an AECD is "any device or element of design that senses temperature, vehicle speed, engine RPM, transmission gear, manifold vacuum, or any other parameter for the purpose of activating, modulating, delaying, or deactivating the operation of the emission control system" and may lawfully be utilized except where prohibited as a “defeat device.” Under the Clean Air Act and its implementing regulations, a “defeat device” is an AECD that reduces the effectiveness of the emission control system under conditions that may reasonably be expected to be encountered in normal vehicle operation and use, unless: (a) such conditions are substantially included in the Federal emission test procedure; (b) the need for the AECD is justified in terms of protecting the vehicle or engine against damage or accident; or (c) the AECD does not go beyond the requirements of engine starting. Furthermore, engine protection is not justified if the need for engine protection is the result of inadequate design of the engine.

The framework EPA will employ for evaluating requests for AECDs is based on the Consent Decree. As you know, the Consent Decree sets forth a schedule for the elimination of all defeat devices from Consent Decree engines, and a limitation, in the interim, on the use of certain strategies which the United States alleges are defeat devices, as set forth in certain appendices. In addition, and separately, the Decree imposes stricter emission limitations and/or test procedures for engines produced after certain dates.

The agency does not have the authority to certify engines that contain “defeat devices” (as such AECDs would be if they are needed as the result of inadequate engine design) and would necessarily require a decision from the court to permit the sale of engines that contain AECDs that would constitute “defeat devices.” The Decree contains a bar against the sale of engines that contain unauthorized AECDs. Footnote one of Appendix C of the Decree further stipulates that the Agency may allow exceedances of the EURO III and Not to Exceed Limits where “ the excess emissions are due to the requirements of engine starting, or conditions resulting from the need to protect the engine or vehicle against damage or accident and there are no other reasonable means to protect the engine or vehicle." In addition, EPA may allow such exceedences "if the manufacturer demonstrates during the certification process that the excess emissions are due to extreme ambient conditions and that there are no reasonable means of meeting such limits under such ambient conditions."

EPA has determined that such conditions for allowing exceedences of the EURO and NTE limits have not been met in some cases. Such engines may be sold upon payment of NCPs as set forth in Section XIV of the Decree. The Agency recognizes that the computed NCPs under the Consent Decree are potentially prohibitive to the sale of engines, and is therefore prepared to discuss with DDC an adjustment of the NCP amounts in cases of demonstrated hardship, and to

discuss alternative approaches to ensuring that the public enjoys the negotiated benefits of the Consent Decree's emission reductions, e.g., mechanisms for paying back tons through other means, but in either case, such a resolution of the issue would require court approval of a Consent Decree amendment. (In any discussion regarding NCPs, we would seek to provide for fundamental fairness as between those companies that have succeeded in addressing the emissions issues relating to the AECDs discussed below and those who have not.) Any alternative approach to the payment of NCPs must include at a minimum the verification of emission impacts of the AECDs in actual use.

In addition, in our view, the use of an engine control strategy or AECD that causes the engine not to conform to the NOx plus NMHC emission limit would mean the period of compliance with that Limit required before termination of the Decree can occur will not begin to run until DDC obtains certificates of conformity for all its NOx plus NMHC engines without use of the noncomplying strategy or AECD. The agency does not have the authority to certify engines that contain "defeat devices" (as such AECDs would be if they are needed as the result of inadequate engine design) and would necessarily require a decision from the court to permit the sale of engines that contain AECDs that would constitute "defeat devices." EPA reiterates its commitment to permit the sale of these engines and will work with the consent decree manufacturers and the court in a timely manner to ensure this outcome.

Our response is an effort to give you as much guidance as possible at this time, but is not a substitute for the certification process. No specific engine or AECD can be approved in this document, as no formal application for certification has been submitted. DDC must still submit applications for certification. Each application for certification will need to provide detail on the engine models and families, and the AECDs, for which approval is sought, with all of the detailed information required in such applications, including but not limited to:

- a description of the engine and the emission control strategies and devices employed, and any ambient conditions under which the strategies and devices will not operate as they do on the tests;
- the reason the AECD is needed;
- what parameters will be sensed and or calculated by the AECD;
- the purpose for every parameter sensed or estimated and how each of those parameters interact to serve as the surrogate for the design parameter in need of protection;
- the method of estimation when surrogates are estimated/calculated rather than sensed/measured, and how well these often multiple estimates correlate with the true state of the design parameter being protected and any resulting tolerance or factor of safety incorporated into the design limits;
- what parameters are modulated in response to the sensed parameter(s) and the range of modulation for each parameter;
- what engine design limit(s) need to be protected by the AECD, if applicable;
- the relationship between the design limits/parameters being protected and those being sensed or estimated as surrogates for the design limits/parameters, if applicable;
- how the AECD will control emissions to the lowest practical level;

- the hierarchy among the AECDs (i.e., when more than one AECD uses the same sensed parameter(s) for activation, which AECD is primary in responding, do the strategies interact in a comparative or additive manner, and how does the hierarchy assure emissions from all AECDs are controlled to the lowest practical level)
- any engine damage that would occur in the absence of the AECD
- the estimated emissions impact of the AECD, if any

As discussed herein and in the Enclosure (which contains a generic description of typical AECDs EPA would likely agree to), and subject to the reservation that any final determination will depend on the submission of complete information at the time of certification, some of your proposed engine control strategies or AECDs will likely be acceptable under EPA's regulations and the Consent Decree requirements. Three of your proposed AECDs are problematic and warrant further discussion here. EPA makes this determination based on the best information currently available. DDC is encouraged to continue to provide to EPA development data and information regarding progress made to eliminate or reduce the need for these AECDs. We are willing to revisit this determination at a future date if compelling information is presented.

1. Condensation Protection, Engine Intake System AECD. The fact that the performance requirements of the Decree would require the use of cooled exhaust gas recirculation ("cooled EGR") was understood at the time of the signing of the consent decree. It was also well understood that diesel exhaust contains water vapor (as a consequence of the combustion of the diesel fuel) and sulfur compounds (as a consequence of the sulfur content of diesel fuel) and that the formation of sulfuric acid in the intake gas stream was likely under certain conditions. Notwithstanding those facts, some manufacturers have only recently commenced efforts to address this issue. Based on our understanding of the technical issues, relief from the performance obligations of the Decree may be justified at cold ambient temperatures, on the order of 25 degrees Fahrenheit and below, without restriction. Above such temperatures, a condensation protection AECD may not be justified because there has been no showing that "the excess emissions result from the need to protect the engine against damage and there are no other reasonable means to protect the engine."

However, we recognize that, having started late to address the issue, some companies may not be able now to design and implement solutions to this problem by October, 2002. We are prepared to agree to a limited AECD for condensation protection above 25 degrees Fahrenheit only for engines produced from October 1, 2002 to January 1, 2004, but in no case for ambient conditions above 50 degrees Fahrenheit. In our view, a condensation protection AECD based solely on ambient temperature might double vehicle emissions, and such an AECD would not be acceptable to EPA in any circumstances. Nor would the Agency agree to a condensation protection AECD for those companies that have developed solutions to address this problem, but choose not to implement those solutions.

The agency would consider agreeing to an AECD for condensation protection if the AECD utilizes commercially available sensors and algorithms to accurately predict when

condensation actually is occurring (i.e. a “smart” condensation AECD) and if the AECD's operation is limited to those periods when condensation is measured or predicted to occur. In addition, the manufacturer must agree to terminate the use of the AECD by January, 2004. Any agreement will be subject to the limitations, reservations and conditions described on page 2. As you know, the increased emissions associated with the use of such an AECD is of significant concern to the agency and to the States.

2. Overheat protection AECD. At the time of the Consent Decree negotiations, the agency agreed to allow an overheat protection AECD, based on a criteria described as “fan-on plus five degrees.” This AECD was expressly designed to allow the Consent Decree engine manufacturers and the truck manufacturers, sufficient time to resize the cooling systems of the trucks to meet the increased heat rejection of engines that provide reduced NOx emissions. While the industry has made some capacity increases in truck cooling systems, thus far it may not have made the changes necessary to fully accommodate EGR-equipped engines. These changes in cooling capacity are technically feasible. It follows, therefore, that an AECD designed to turn off the vehicle's pollution control system premised on the use of an inadequate cooling system, is not “necessary” and cannot be approved on a long-term basis. We believe that, had the industry set out to address this issue commencing in 1998, there was ample time to develop and implement the necessary changes to the vehicle’s cooling system. Since that did not occur, we are now faced with a situation where there may be insufficient lead time to do so prior to October, 2002.

Manufacturers of trucks need to know in fairly short order what horsepower ratings they will be able to offer their customers in October, 2002. Accordingly, as in the case of the condensation protection AECD, the agency will allow the use of a “fan-on plus 5 degrees F” AECD for engines produced during the time period between October 2002 and January 1, 2004, subject to the limitations, reservations and conditions described above.

3. Air Handling System Protection AECD. We understand that the engine manufacturers are now seeking an engine protection AECD which operates under elevated ambient temperatures and altitudes, and under high engine load. The use of the AECD is also bounded by design constraints to be selected by the manufacturer. This request is perhaps the most difficult to analyze and address. Depending on the design constraints selected by the manufacturer, granting this request could result in very high NOx levels on the hottest days when ground-level ozone is the greatest concern. On the other hand, where the manufacturer has selected state-of the-art materials (e.g., titanium compressor blades for the EGR, heat resistant charge air cooler materials, etc) and designs, there may not be much more that can be achieved with the technology, and the emission increases associated with the AECD may be minimal. However, most manufacturers have not yet made final decisions in these areas. For this reason, the agency can only state at this time that it will likely agree to an AECD request in this area, but that it will require far more detailed information concerning material choices, design considerations and emission impacts before deciding whether the requested AECD is “necessary” for engine protection, and any agreement will be subject to the limitations, reservations and conditions described on page 2.

As a final matter regarding the AECD framework, we should note that the agency will not

allow the use of any AECD that would cause a violation of the FTP standard and will only allow an AECD that would cause a violation of a Euro III Composite Value Limit, even with resolution of NCPs and other issues, upon a clear showing of need. Our goal is to resolve any AECD, NCP, alternative approach, or termination issues early so that we have an opportunity to obtain any necessary approvals from the court well in advance of the time for certification.

We will be glad to continue discussing these issues with you. We would hope to resolve any issue concerning NCPs or alternative approaches and termination issues well in advance of the dates for certification. Please contact Bruce Buckheit, Director of the Air Enforcement Division if you have any questions.

Sincerely,

Steven A. Herman
Assistant Administrator
Office of Enforcement and Compliance Assurance

Robert Perciasepe
Assistant Administrator
Office of Air and Radiation

Enclosure

Enclosure

EPA's Evaluation of Consent Decree Manufacturer's Preliminary AECD Requests

Table 1. Problematic AECDs, discussed in more detail in the accompanying letter

AECD Concept	Description
#1 -Air Handling System Protection	Prevents air handling system components, such as the turbocharger and/or charge air cooler, from exceeding design limits during conditions of elevated ambient temperatures and altitudes, and under high engine load. EGR is reduced or eliminated and fuel injection timing is advanced when 1) ambient temperatures exceed the straight line defined by 90°F at sea level and 68°F at 5,500 feet; 2) engine loads exceed 80% of the maximum torque at a given engine speed; and 3) a component of the air handling system is within 10% of its specified design limit.
# 2 - Overheat Protection	Prevents the engine from overheating by reducing EGR and/or advancing fuel injection timing when 1) the engine's coolant temperature exceeds the cooling fan engagement temperature by more than 5°F; and 2) the engine is operating under conditions equivalent to ambient temperatures greater than 100°F and at least 75% of the torque available for a given engine speed.
# 3 - Condensation Protection, Engine Intake System	Prevents condensation and formation of sulfuric acid in the intake manifold by reducing or eliminating EGR flow during engine operation below ambient temperatures of 25°F during the conditions which can lead to condensation in the intake manifold, and by modulating EGR flow for ambient temperatures between 25° F and 50° F during conditions which can lead to condensation in the intake manifold.

Table 2. AECDs Likely To Be Approved, subject to submission of detailed information as described in the accompanying letter, page 3.

AECD Concept	Description
# 1 - Condensation Protection, EGR System	Prevents condensation and formation of sulfuric acid in the EGR system during engine warm-up by reducing or eliminating EGR flow as a function of coolant temperature and intake manifold pressure.
# 2 - White Smoke / Misfire Protection	Fuel injection timing is advanced to prevent engine oil dilution, misfire, and white smoke emissions under conditions of light load and ambient temperatures resulting in intake manifold temperatures below 60°F.
# 3 - Black Smoke/Acceleration Strategies	Prevents smoke emissions during rapid accelerations by modulating EGR , fuel injection timing and rate, and/or charge air rate for short periods, typically less than 5 seconds.
# 4 - Extended Idle / PTO Protection	Prevents condensation and sulfuric acid formation on engine components by reducing or eliminating EGR flow for extended idle or PTO (power take off) operation having sustained light loads, i.e., loads below the NTE zone.
# 5 - Engine Starting Strategies	Injection timing may be advanced and EGR may be reduced or eliminated during engine cranking speeds to achieve reliable engine starting and stable engine operation upon engine start.
# 6 - Warm-Up Strategies	Prevents white smoke and misfire during engine warm-up by eliminating or reducing EGR flow and by advancing injection timing when engine coolant temperatures are less than nominally 5 percent of the thermostatically controlled engine operating temperature.
# 7 - General Engine Protection - Extreme Conditions / Malfunctions	Modulates the engine and emissions control system to prevent catastrophic failure of major engine and emissions control systems (e.g. lube oil, coolant , EGR) when system threshold exceedences are detected (e.g. loss of engine lubrication). Emissions control modulation may include, but is not limited to, reduced EGR and fuel rates and advanced injection. The engine operator is notified by both a warning light and reduced engine performance when a system threshold is exceeded.
# 8 - Diagnostic Procedures	Modulates the emissions control system over a prescribed routine to check for functional faults. Operator notified when a system fault is detected to ensure continued proper operation of the emissions control system.
# 9 - Normal Modulation of Emission Control System	Modulates the engine/emissions control system in order to comply with applicable emissions limits under the broad range of operating conditions represented by the FTP, Euro, and NTE tests. Modulation may include, but is not limited to, the fuel injection system parameters, EGR rate, and intake air rate.